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soft white wheat production

Alberta
AGRICULTURE
Field Crops Branch
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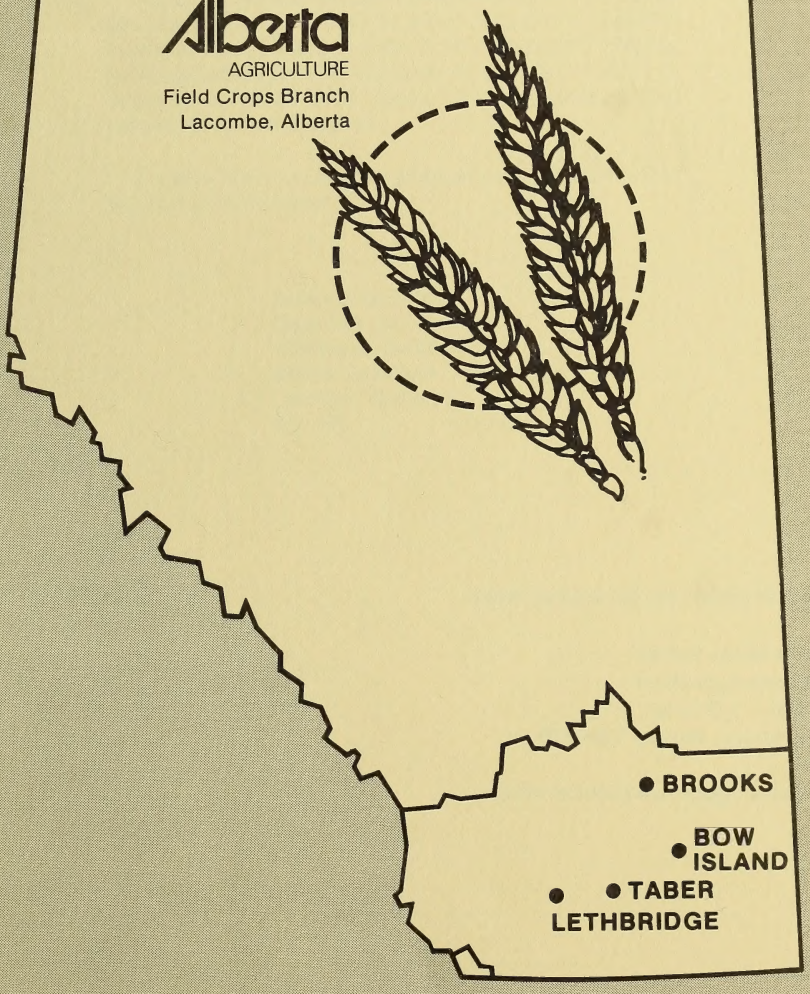

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INTRODUCTION

Soft white spring wheat has become a very important crop for the irrigated areas of southern Alberta. To help learn which successful production practices are being employed by top producers, a survey was conducted during the late fall and early winter of 1983-84. Forty-three above average producers were individually selected by their district agriculturist to answer 143 questions dealing with all aspects of their irrigated soft white wheat production practices. Each farmer was asked to think of a "typical year" (if there is such a thing) and their preferred or best management practices that would maximize yields within economic realities on their farm.

The data were compiled and analyzed showing trends by percentage which indicated the most popular production practices employed by top producers of soft white wheat. When percentages were suspected of showing regional differences, the data were subdivided into two sub areas. The northern sub area was the Brooks district, and the southern sub area consisted of Seven Persons, Vauxhall, Taber, and Lethbridge districts. Data not subdivided were perceived to have no regional differences.

The latest research results and recommended production practices from the professional community are also presented in this publication.

The producers surveyed had approximately a 40 per cent higher average 1983 yield (80 bushels/acre) than the provincial average yield (under 60 bushels/acre). No one production factor automatically resulted in this higher yield. It is a combination of many factors each contributing in a small way to an overall large yield increase.

Information in this publication follows the flow of events through a production year starting with fall tillage operations after harvest. The survey information is mainly subjective but clear trends are indicated when large percentage differences occur.

Readers are challenged to compare their production practices with those of the top producers.

SURVEY RESULTS AND DISCUSSION

CHARACTERISTICS OF THE SURVEY SAMPLE

Number of producer survey returns	43
Average years of experience growing irrigated soft white spring wheat	10 years
Average number of cultivated acres per farm	813
Average acreage sown to soft white wheat per farm	300
Percent of producers practising continuous cropping	100%
Soil types involved in survey:	
Brown	86%
Dark brown	14%
Soil textures involved in survey:	
Sandy loam	39%
Sandy clay loam	32%
Clay loam	27%
Others	2%

Districts covered by the survey were:

Lethbridge, Taber, Seven Persons, Vauxhall, and Brooks.

OBSERVATION:

The producers in this survey have rather large irrigation farms which are continuously cropped (that is no summerfallow), have many years of experience and represent all the major irrigation areas, soil types and textures of southern Alberta. Differences in production methods will occur when such a large area is being represented. The majority percentage will indicate the most popular procedure, the other percentage indicates alternative methods or procedures.

PRODUCTION PRACTICES

ROTATIONS USED:

Alfalfa Hay - 4 to 5 years Soft white wheat Soft white wheat Soft white wheat Barley	57%
Sugar beets Soft white wheat Soft white wheat Barley	29%
Other rotations involving canola, beans, corn hard red wheat, potatoes, flax & peas	14%

OBSERVATION AND DISCUSSION:

The majority (57%) used alfalfa hay in their rotation. This is an excellent method to improve and build the soil, increase the organic matter content and thereby reduce crusting, improve water holding and infiltration rate, improve soil structure and texture, and help prevent disease build-up. Please see Table "Rotations Used in Sub Areas".

PREVIOUS CROP:

When asked if the crop to be planted and grown in this survey would be grown on summerfallow land or on what type of stubble, 82 per cent said it would be planted on soft white wheat or wheat stubble, 14 per cent on plowed hay land, and 4 per cent on land previously sown to sugar beets. Therefore most of the production practices,-e.g. tillage operations, fertilizer application, weed control, etc., would be appicable to recropping on wheat stubble land.

ROTATIONS USED IN SUB AREAS

Southern Sub Area*		Northern Sub Area*	
Sugar beets Soft white wheat Soft white wheat Soft white wheat or barley	24%	Alfalfa Hay - 4 to 5 years Soft white wheat Soft white wheat Soft white wheat Barley, oats, spring wheat or S.W. wheat	73%
Soft white wheat Soft white wheat Soft white wheat or barley Canola or flax	24%	Alfalfa Hay - 4 to 5 years Soft white wheat Soft white wheat Soft white wheat Peas	9%
Alfalfa Hay - 4 to 5 years Sugar beets Soft white wheat Soft white wheat or barley	19%	Soft white wheat Soft white wheat Corn Corn	9%
Alfalfa Hay - 4 to 5 years Soft white wheat Soft white wheat Soft white wheat Barley	14%	Other rotations involved sugar beets, flax and straight cereal crops.	
Other rotations involved potatoes, beans, or straight cereal crops.			

* Northern sub area equals Brooks district; southern sub area equals Seven Persons, Vauxhall, Taber, and Lethbridge districts.

HANDLING OF THE PREVIOUS CROP TRASH

	%
Not removed	79
Baled or collected	18
Not applicable (beet land)	3

OBSERVATION AND DISCUSSION:

Most of the top producers recognize the value of returning the crop trash to the soil. It helps prevent soil erosion, returns the many nutrients contained in the trash to the soil, improves the water holding capacity and infiltration rate of the soil, improves the nutrient exchange capacity, and improves the structure and texture of the soil.

Soil problems

The most frequently mentioned soil problems were:

	%
1) Crusting	66
2) Salinity	53
3) Wind erosion	52

Soil tillage practices

	%
Conventional till	100
Minimum till	0
Zero till	0

FALL TILLAGE OPERATIONS (TOTAL SURVEY)

	Per Cent Doing This Operation	%	Implement Used
One tillage	100	33	Plow
		30	Cultivator
		28	Double disc
		9	Others
A second tillage	77	33	Cultivator
		27	Double disc
		12	Plow
		12	Granular applicator
		9	Float
		7	Others
A third tillage	60	35	Cultivator, harrows & packers
		27	Float
		15	Harrows & packers
		12	Fertilizer - granular or anhydrous
		7	Double disc
		4	Herbicide liquid applicator
A fourth tillage	26	55	Cultivator
		18	Fertilizer - granular or anhydrous
		9	Harrows & packers
		9	Float
		9	Plow
A fifth tillage	9	50	Cultivator & harrows
		25	Anhydrous applicator
		25	Float

OBSERVATION

Most producers performed two fall field operations with the majority of producers having finished their fall tillage operations by the end of the third trip. The mouldboard plow is still a popular implement along with the cultivator and double disc.

FALL TILLAGE OPERATIONS by SUB AREAS

Southern Sub Area*	% Doing This Operation	Implement Used		Northern Sub Area*	% Doing This Operation	Implement Used	
One Tillage	100	Cultivator	33%	One tillage	100	Plow	41%
		Double disc	33%			Cultivator	27%
		Plow	24%			Double disc	23%
		Granular fertilizer	10%			Granular fertilizer 5%	
						Subsoiler	5%
A Second Tillage	81	Cultivator	47%	A Second Tillage	73	Double disc	44%
		Plow	18%			Cultivator	19%
		Double disc	12%			Float	19%
		Granular applicator	12%			Granular applicator	12%
		Harrows	6%			Plow	6%
		Subsoiler	6%				
A Third Tillage	71	Cultivator	34%	A Third Tillage	50	Float	46%
		Harrows & packers	20%			Cultivator	36%
		Double disc	13%			Harrows & packers	9%
		Float	13%			Herbicide liquid	9%
		Granular fertilizer	13%				
		Anhydrous	7%				
A Fourth Tillage	24	Cultivator	40%	A Fourth Tillage	27	Cultivator	66%
		Plow	20%			Granular	
		Harrows & packers	20%			Float	17%
A Fifth Tillage	5	Anhydrous	100%	A Fifth Tillage	14	Cultivator	66%
						Float	33%

* Northern sub area equals Brooks district; southern sub areas equals Seven Persons, Vauxhall, Taber, and Lethbridge districts.

What implement was used for the final fall field operation?

	Total Survey %		Southern* Sub Area %		Northern* Sub Area %	
Cultivator	44		29		59	
Cultivator, harrow and packers	12	56	19	48	5	64
Harrow & packers	14		24		5	
Float	9		5		14	
Double disc	9		9		9	
Anhydrous	7		9		4	
Plow	5		5		4	

* Northern sub area equals Brooks district; southern sub area equals Seven Persons, Vauxhall, Taber, and Lethbridge districts.

OBSERVATIONS AND DISCUSSION:

Ten producers used a float in the fall. Six of these ten followed the float operation with another field tillage, usually with a cultivator, to leave the land in a roughened-cloddy condition, which will help prevent soil erosion. The most common final fall field tillage was performed with a cultivator, probably for the same soil protection reason. Remember, too much fall tillage increases the chance of wind soil erosion.

Fall Irrigation

Thirty-three per cent of the producers who irrigated **prior to** their first fall field tillage operation, applying about 100 mm (4 inches) of water per acre. A further 7 per cent irrigated **after** their first fall tillage operation. This meant that 40 per cent, in total, fall irrigated.

The amount of water applied per acre:

	%	
1.5 inches	18	
2 inches	6	
3 inches	24	
4 inches	35	76%
5 inches	17	

This irrigation brought their soil moisture content to 76 per cent (average) of field capacity.

When considering fall irrigation one has to determine whether the existing soil moisture level is above or below 50 per cent of the available range. Where the moisture is in the lower half of the available moisture range, irrigation is recommended. Also, if the lower part of the active root zone depth is dry, irrigating is highly advisable.

It is recommended that you raise the available soil moisture to about the three-quarter level so that the benefits can be derived from snowmelt and early spring precipitation. Planned fall irrigation and winter spring precipitation should eliminate the need for early spring irrigation. Of course, there is always a **risk** associated with fall irrigation, if above normal precipitation does occur, causing a delay in early spring land preparation and seeding, particularly on heavy textured soils which take longer to dry out.

Time of first spring field operation

	%	Southern* Sub Area		Northern* Sub Area	
Last half of March	0	5		0	
1st half of April	18	24	86	9	
Last half of April	47	62		32	91
1st half of May	35	9		59	

* Southern sub area data are from Taber, Vauxhall, Seven Persons and Lethbridge districts. Northern sub area data are from the Brooks district.

DISCUSSION

These top producers noted that, depending on the year, the majority will start field work about the middle of April in the southern area, and early May in the northern area. Research generally shows that cereal crops respond to early seeding. In order to accommodate early seeding, as much work as possible is done in the fall, and spring preseeding operations must start early. However, tilling the land too early only adds unnecessary risk to drying the seedbed and, in some cases, increases the possibility of soil erosion. The top producers feel that the last half of April is a good starting time.

SPRING TILLAGE OPERATIONS

	Per Cent Doing this Operation		%	Implement Used
One tillage	100		52	Cultivator
			14	Harrows
			11	Granular fertilizer applicator
			9	Anhydrous
			7	Rod weeder
			7	Others
A second tillage	82		44	Cultivator & harrows
		39	22	Anhydrous applicator
			17	Granular fertilizer
			6	Double disc
			11	Others
A third tillage	50		64	Cultivator & harrows
			14	Harrows
			22	Others
A fourth tillage	20		33	Harrows & packers
			33	Fertilizer applicator
			34	Others

OBSERVATION

The majority do two preseeding operations mainly with a cultivator, cultivator-harrow type of implement. For 39 per cent the second operation is to apply fertilizer. Seedbed firming operations are apparent through the use of harrow, packers and rod weeder implements.

Seedbed firmness - One method of measuring seedbed firmness is to observe the depth to which the sole of your work boot or shoe sinks into the soil. The shallower the foot print, the firmer the seedbed.

Your Shoe Sole Sinks		%	
⅛ to ¼ inch	Very firm	9	
½ inch	Firm	12	77%
¾ inch	Slightly firm	28	
1 inch	Slightly loose	28	
2 inches	Loose	23	
3 inches or more	Very loose	0	

OBSERVATION: A good seedbed is a firm seedbed.

Seedbed moisture just before seeding	%	
Poor	0	
Fair	24	
Good	66	76%
Very good	10	

Depth to soil moisture from surface at seeding	%	
At surface	9	
½ inch	9	
¾ inch	12	79%
1 inch	16	
1-½ inches	33	
2 inches	14	
2-½ inches	5	
3 inches	2	

OBSERVATION:

Top producers maintain seedbed moisture near the surface by minimizing pre-seeding field tillage operations and obtaining a firm seedbed.

Final seedbed rating:	%	
Poor	0	
Fair	14	
Good	70	86%
Very good	16	

OBSERVATION:

Good yields start with a good seedbed.

Importance of a seedbed

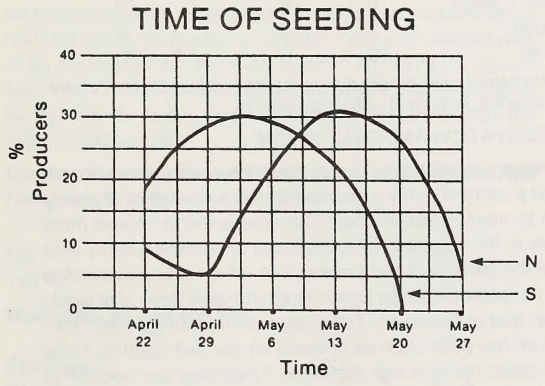
The question was asked, "When considering all the various farming operations and inputs under your control, and their relative importance, how high would you rate seedbed preparation, compared to the other operations?" (Scale 0 - 9)

Scale		%	
0 - 3	Little importance	2	
4 - 6	Medium	20	
7 - 8	High	40	78%
9	Most important	38	

OBSERVATION AND DISCUSSION

Most of these producers believe seedbed preparation to be of major importance. This agrees with research findings. Since the total yield potential of a cereal crop is determined very early in life (by the fourth leaf stage), it is very important to give the young seedling ideal conditions. This will trigger the plant to set a maximum yield potential, that is the number of tillers, number of flowers per head, and therefore seeds, etc. We want the young seedling to believe that it's going to be a great year, so that it will set the maximum yield potential. Of course, the remaining growing season will determine how much of this total yield potential is fulfilled, but at least the maximum potential has been set.

Time of seeding	%	
April 19 - 25	12	
April 26 - May 2	18	
May 3 - 9	26	70%
May 10 - 16	26	
May 17 - 23	14	
May 24 - 30	4	



N = Northern sub area = Brooks district
S = Southern sub area = Lethbridge, Taber, Vauxhall, Seven Persons district

OBSERVATION AND DISCUSSION

Seeding should be underway near the first of May in the southern Sub area, and about the second week of May in the northern sub area, according to the producers surveyed. Wheat will germinate at a minimum soil temperature of 4°C but prefers 8-10°C. Spring seeding of wheat should be as early as possible, taking into consideration soil temperature and weed growth. To compare your soil temperature with the above figures, temperature readings are taken at seeding depth twice a day, around 8:30 am and 4:00 pm, and an average of the two readings is used.

Why do you seed at this time?

	%	
Soil temperature	50	Combined reason in many cases.
Weed control	30	
Calendar	8	
Soil moisture	10	
Others	2	

Soil temperature at seeding

	%	
5 - 7°C	21	
8 - 10°C	47	98
10 - 15°C	30	
Don't know	2	

OBSERVATION

Ninety-eight per cent of the top producers were aware of their soil temperature at seeding, with over half using this as their main guide to seeding time.

Seeding implement used

	%	
Hoe press drill	72	84
Cultivator & hoe press drill	12	
Double disc press	8	
Double disc (no press)	2	

OBSERVATION

The hoe press drill is most popular. The reasons given for the hoe press drill preference were:

Good penetration
Good depth control
Good in trash
Good packing

DISCUSSION

Another reason for the hoe press drill's popularity may be related to its adaptability to dryland seeding in southern Alberta. Since many irrigation farmers also farm dryland, only one seeding implement is purchased, the one best adapted to both situations. Research has indicated that there is no significant difference in final yield caused by commonly used seeders, provided they are properly adjusted and can handle the amount of trash present. The seeder must open a furrow to sufficient moisture, accurately meter seed into each run, place the seed at a uniform depth, cover the seed with soil and pack it around the seed.

Seeding depth

	%	
1 to 1¼ inch	5	
1¼ to 1½ inch	5	
1½ to 2 inches	17	58%
2 to 2½ inches	31	
2½ to 3 inches	21	
3 to 3½ inches	21	

OBSERVATION AND DISCUSSION

Most producers seed within 2½ inches of the soil surface. Modern varieties of soft white wheat are more sensitive to seeding depth than are hard red spring wheat varieties. They are semi-dwarfs with a short coleoptile length. This means seeding should be as shallow as possible for optimum results, provided sufficient moisture is present to allow germination. Therefore, it is very important to achieve a good firm seedbed with moisture close to the surface to facilitate shallow seeding of soft white wheat. Deep seeding (over 2½ inches) increases the chances of root rot, places the seed in cooler soil which slows germination and growth, reduces emergence and will likely result in decreased seedling vigor.

Field operations after seeding

	%		Southern* Sub Area		Northern* Sub Area
No operations	40		52		32
Harrow	34		19	33	45
Harrow & packers	7		14		0
Rod weeder	5	53%	0		9
Herbicide application & harrow (x2)	7		10		5
Boarder dyking	7		5		9

OBSERVATION

Over 50 per cent of the producers do a land packing-smoothing operation after seeding. Since hoe press drills were mainly used for seeding, the producer must be careful that a harrowing operation does not increase the seeding depth sufficiently to reduce emergence by closing the valleys left by the press wheels.

* Northern equals Brooks district; southern equals Seven Persons, Vauxhall, Taber and Lethbridge districts.

Class of seed used

	%
Pedigreed	77
Canada No. 1	10
Farmer's	13

Germination testing

	%
Tested	88

Eighty-eight per cent of the producers had germination test results for their seed, and 83 per cent reported the germination was between 80 - 100 per cent.

DISCUSSION

A germination test result is an important piece of management information. Increasing the seeding rate has been used to compensate for poorer germinating seed. This is not a good practice. It is better to purchase new seed with good germination. Seed stocks with poor germination may show low seedling vigor, be already diseased, or be more susceptible to disease, resulting in reduced yields.

How often do you purchase pedigreed seed:

	%	
Every year	35	
2nd year	29	91%
3rd year	27	
4th year	7	
Other 2		

Preference when purchasing seed

	%	
Foundation	14	
Registered	24	96%
Certified	58	
Canada No. 1	2	
Farmer's	2	

OBSERVATION

Within a three-year period 91 per cent of these top producers will purchase pedigreed seed mainly at the certified level or above (96%). They realize the value of a guaranteed level of genetic purity, germination, freedom from disease and weed seeds, which can only be obtained from pedigreed seed. Good seed contributes to higher yields.

Type of seed treatment used this year

	%	Southern* Sub Area		Northern* Sub Area	
Dual (fungicide & insecticide)	50	62	95	32	59
Fungicide	30	33		27	
Insecticide	0	0		0	
None	20	5		36	

* Northern equals Brooks district; southern equals Seven Persons, Vauxhall, Taber and Lethbridge districts.

How often do you seed treat?

	%	Southern* Sub Area	Northern* Sub Area
Every year	77	95	59
Every 2 years	0	0	0
Every 3 years	2	0	4
Every 4 years	0	0	0
Every 5 years	0	0	0
Seldom	2	0	5
Never	19	5	32

* Northern equals Brooks district; southern equals Seven Persons, Vauxhall, Taber and Lethbridge districts.

OBSERVATION AND DISCUSSION

Seventy-seven per cent of these top producers believe in seed treatment every year, mainly with a dual seed dressing. The farmers in the southern sub area seem to believe more firmly in the benefits of treating seed and treating every year than the farmers of the northern sub area. Unless wireworms are a problem, a single action fungicide seed treatment would be all that is necessary. Fungicides destroy fungal pests carried on the seed such as covered smuts, leaf-spotting fungi, and seed decay fungi. Systemic fungicides are needed to destroy fungi in the seed such as loose smuts and protect early growth of the seedling.

Variety sown

Fielder	100%

NOTE: A new variety "Owens" received a temporary licence in 1984, after this survey was conducted. The main advantage of Owens is its immunity to strip rust. Owens will out yield Fielder only when heavy strip rust infection occurs, otherwise, their performance is similar. Risk of strip rust is greatest in the irrigation area east of Taber and south of highway number 1. Owens is slightly inferior to Fielder in test weight, black point percentage, and lodging, but is slightly superior to Fielder in shattering resistance. A strip rust forecast will be issued every March by the Agriculture Canada Research Station, Lethbridge.

Introduction of a new variety

The top producers, on average, answered in the following way:

When new varieties are first offered, with claimed advantages for your area; "I wait -

	%	
Zero years	24	
One year	41	91%
Two years	26	
Three years	9	

and then purchase ***pedigreed** (95%) class of seed, enough to sow **34 per cent** of my wheat acres that year. I then try the new variety for **2-3 years** - (88%) before I reach a conclusion on its adaptability to my farm."

* Pedigreed seed is seed falling into the Foundation, Registered or Certified levels as defined by the Canada Seeds Act.

OBSERVATION

One year is not sufficient to evaluate a new variety. Top producers try new varieties early, within 2-3 years after their release, on a small portion of their land, using pedigreed seed.

Seeding rate

	%	
1¼ bushels/acre	2	
1½ bushels/acre	35	93%
1¾ bushels/acre	28	
2 bushels/acre	30	
2¼ bushels/acre	5	

OBSERVATION

Most producers are seeding at 1½ to 2 bushels/acre. Research indicates 1¼ to 1½ bushels/acre to be an adequate seeding rate. A proper seeding rate will result in 12 - 20 plants per square foot. This means placing a seed about every inch of row with a 6 inch row spacing, at 85-90 per cent germination, and allows for other small losses. Since Fielder contains about 850,000 seeds per bushel, a 1¼ bushel per acre seeding rate, at 85 per cent emergence, will result in 20 plants per square foot. Very much higher seeding rates waste expensive seed, as significantly higher yields would not be expected from the higher seeding rate.

Do you cross seed (Seed ½ the seed in one direction, the remaining ½ in the opposite direction)

	%
No	98
Yes	2

How often do you soil test

	%	
Every year	44	90%
2nd year	12	
3rd year	12	
4th year	2	
5th year	20	
Never	10	

OBSERVATION AND DISCUSSION

At least once every five years, 90 per cent of the producers test their soil to aid in their fertilizer application decisions, with almost half of the producers soil testing every year. Too much nitrogen increases the protein level of soft white wheat. A low protein level is required for pastry flour (prefer less than 10.5 per cent on a 13.5 per cent moisture basis). A fertility balance is also important in obtaining low protein levels, particularly between nitrogen and phosphorus. Through the use of soil test results, a farmer can better ascertain the proper levels to apply to maximize yield without sacrificing quality. Periods of water stress during the latter part of the growing season will also raise protein levels. Therefore, a farmer should irrigate to maintain soil moisture in the upper half of the available range throughout the growing season.

Depth of soil samples taken for test

	%
0 - 6 inches	100
6 - 12 inches	85
12 - 24 inches	47

DISCUSSION

Under irrigation significant quantities of nitrogen can be leached below the 6 inch level. In order to adjust soil test recommendations to account for this extra nitrogen, 6-12 and 12-24 inch samples must be taken. Sampling deeper than 6 inches greatly improves the reliability of nitrogen and sulphur test results. If soil problems such as salinity or solonetzic soil are suspected, 6-12 and 12-24 inch samples should be taken.

Soil pH

	%
6.6 to 7.0	11
7.1 to 7.5	30
7.6 to 8.0	32
8.1 to 8.5	4
Don't know	23

DISCUSSION

Most of the soils growing soft white wheat in southern Alberta have an acceptable pH range of 7-8.

Do you follow soil test recommendations

		%
Apply:	Less than	17
	Equal to	58
	More than	25

DISCUSSION

Soil test results are a guideline. Individual farmers know their land, climate, and irrigation schedule best and can adjust the soil test results to best suit these conditions and target yields. Without a soil test, there is no starting point. Too little, too much, or out of balance fertilizer application can be very costly in lost yield or purchased fertilizer costs.

Nitrogen applied - (lb/acre)

	%		Southern* Sub Area		Northern* Sub Area	
51 to 60	5		0		0	
61 to 70	12		0		23	78
71 to 80	9		0		18	
81 to 90	16		10		23	
91 to 100	23	62%	35	75	14	
101 to 110	23		40		9	
111 to 120	5		5		5	
141 to 150	5		10		0	

* Northern equals Brooks district; southern equals Seven Persons, Vauxhall, Taber and Lethbridge districts.

OBSERVATION

Most of the top producers are applying 81 to 110 lb of actual nitrogen per acre. Southern producers are at the higher end of this range, while northern producers are at the lower end. An 80 bu/acre crop will remove about 100 lb/acre of nitrogen when only the grain is removed from the field. Please see discussion on page 8 following "Was the Nitrogen Deep Banded" chart.

Form of nitrogen applied

	%
Both liquid and granular	7
Granular	55
Anhydrous	36
Alfalfa	2

When was the nitrogen applied

	%
Fall	36
Spring	62
Spring, with seed	0
Fertigation	2

NOTE: The southern district had approximately the same distribution between spring and fall applications as did the northern district. The data also indicated that 73 per cent of the nitrogen applied in the fall was of the granular form, and 27 per cent was anhydrous.

DISCUSSION

Fall broadcast-incorporated urea fertilizer is not recommended, as losses are usually great (20-50%) in southern Alberta. If a producer cannot deep band the nitrogen, only 34-0-0 type of nitrogen should be used for fall broadcast and incorporation.

Was the nitrogen deep banded

	%
Yes	43
No	57

OBSERVATION AND DISCUSSION

1. Anhydrous application was considered deep banding which accounts for 36 per cent out of the above 43 per cent reported in the "Nitrogen Deep Banded" chart.
2. Recent research results obtained by Agriculture Canada at Lethbridge and Vauxhall indicate 88 lb/acre of applied nitrogen raised yields from 49 bu/acre to 77 bu/acre and maintained a low protein level of 9.4 per cent. Adding another 44 lb/acre of nitrogen only raised the yield another 7 bu/acre but raised the protein content to 10.7 per cent. In other words, a 50 per cent increase in applied nitrogen only raised the yield 10 per cent and moved the protein in the wrong direction. Irrigation throughout the growing season, maintaining soil moisture above 300 millibars moisture tension, and supplying adequate phosphorus, ranging from 55 to 110 lb P_2O_5/acre were also needed to ensure yield and low protein.

   If soil test results indicate low soil nitrogen (less than 30 lb/acre), then up to 130 lb/acre of applied nitrogen can be used. This rate is decreased as nitrogen soil test results increase. (Source - Alberta Agriculture research).

Soil Test Results	Applied Nitrogen
30 lb/acre	130 lb/acre
50 lb/acre	110 lb/acre
75 lb/acre	100 lb/acre
100 lb/acre	70 lb/acre

3. It is becoming more popular in the Brown soil zone to apply nitrogen in the ammonia form by deep banding in the late fall. This saves valuable spring time, facilitating earlier seeding and helps to conserve seed bed moisture and firmness. Research has shown this to be a valid alternative to spring application. Losses of nitrogen through denitrification and leaching are not usually very great in the Brown soil zone when anhydrous ammonia or urea forms are deep banded. The risk of loss must be weighed against the advantage of fall application.

Phosphorus applied (P_2O_5 lb/acre)

	%	Southern* Sub Area		Northern* Sub Area	
None	2	18	5		0
21 to 30	16		19		14
31 to 40	16	53	14		18
41 to 50	21		14		27
51 to 60	16		14	38	18
61 to 70	9	23	5		14	41
71 to 80	14		19		9
Over 100	5		10		0

* Northern equals Brooks district; southern equals Seven Persons, Vauxhall, Taber and Lethbridge districts.

OBSERVATION AND DISCUSSION

1. About one-half of the producers are using between 30 and 60 lb of P_2O_5 per acre, with another quarter in the 60 to 80 lb range.
2. A proper nitrogen to phosphorus ratio helps obtain a low grain protein level. This survey indicated that a 2:1 nitrogen phosphorus level is being used by the majority of the top producers. Research has indicated that 30 lb of P_2O_5/acre is the optimum application required for maximizing soft white wheat production. Rates above 30 lb of P_2O_5/acre are only necessary when soil tests indicate a low P_2O_5 level and vice versa.

Phosphorus Recommendations at Various Soil Test Levels

Soil Test Level P (lb/ac)	P_2O_5 Recommendation (lb/ac)
Over 60	10
50 - 60	15
40 - 50	20
30 - 40	30
20 - 30	40
10 - 20	50
0 - 10	60

(Source: Alberta Agriculture research)

3. All nutrient requirements must be present in proper proportions for maximum yields. Remember, a crop can only produce up to its most limiting factor whether that be water, fertility, photoperiod, length of growing season, heat units, etc.
4. High rates of residual P_2O_5 are common in many southern Alberta irrigated soils. This has resulted from high rates of P_2O_5 having been applied on specialty crops over the last 40 to 50 years. This residual P_2O_5 reduces the importance of P_2O_5 being applied with the seed, obscures the effect of deep banding, and reduces the application requirements.

Form of phosphorus used:

Granular	100%

When was the phosphorus applied:

	%
Fall	11
Spring	27
Spring, with seed	60
N/A	2

Was the phosphorus deep banded:

	%
Yes	5
No	93
N/A	2

OBSERVATION:

Most of the top producers applied granular phosphorus with the seed. Deep banding has not become very popular yet. Other forms of phosphate fertilizer were not readily available when this survey was conducted.

Potassium applied (lb/acre)

	%	Southern* Sub Area		Northern* Sub Area	
None	48	50		45	
11 - 20	14	23		5	
21 - 30	14	14	37	14	
31 - 40	0	0		0	
41 - 50	5	0		9	
51 - 60	16	9		23	37
Over 60	5	5		5	

* Northern equals Brooks district; southern equals Seven Persons, Vauxhall, Taber and Lethbridge districts.

Form of potassium applied

Granular	100%

When was the potassium applied?

	%
Fall	24
Spring	57
Spring, with seed	19

Was the potassium deep banded?

No	100%

DISCUSSION

Research conducted over the past 3 years on many sites in southern Alberta has not indicated a need for potassium. If soil test results (0-6 in. level) show:

(a) over 300 lb/acre - potassium should not normally be applied.
(b) between 250-300 lb/acre - a test strip could be tried.
(c) under 250 lb/acre - a response may be possible from the addition of potassium

Sulphur applied - (lb/acre)

	%	Southern* Sub Area	Northern* Sub Area
None	91	85	95
Under 10	5	10	0
11 - 15	0	0	0
16 - 20	2	5	0
21 - 25	2	0	5

* Northern equals Brooks district; southern equals Seven Persons, Vauxhall, Taber and Lethbridge districts.

OBSERVATION & DISCUSSION

Very few top producers are applying supplemental sulphur. Soft white wheat needs about 10 lb of sulphur per acre to produce a 100 bu/acre crop. Research has shown that irrigation water contains about 30 lb of sulphur for every 12 acre inches applied. Therefore, even ignoring the soil sulphur supply, more than enough sulphur will be supplied through the irrigation water.

Micronutrients used

Most producers (70%) were not using micronutrients. The producers who used micronutrients reported using various combinations of copper, zinc, boron, manganese and iron. The application rate was about 2 to 5 lb/acre. Soil test results indicated the need for, and type of, micronutrient to be applied. Recent research has indicated, through tissue analysis, that micronutrients are rarely deficient in our soils. Norms, or values, established mainly in the United States for micronutrients are not applicable to Alberta soils. Leaf tissue analyses is the best indication of micronutrient deficiencies rather than soil test results at this time. Tissue analysis shows what the plant is actually receiving from the soil. Alberta soils testing low in micronutrients, compared to established norms, have produced plants that have not been low in micronutrients when tissue analyses were performed. More research is needed in this area.

What is the main cause if an uneven or patchy stand occurs

1st Choice	%
Deficient moisture	67
Soil surface crusting	14
Depth of seeding	7
Disease or insects	5
Chemical residue	5
Others	2

2nd Choice	%
Soil surface crusting	32
Depth of seeding	29
Insufficient packing before seeding	13
Deficient moisture	13
Others	13

OBSERVATION AND DISCUSSION

Preservation of seedbed soil moisture through minimum spring tillage, obtaining a firm seedbed, doing as many seedbed preparation operations in the fall as possible, and controlling winter annual and other weeds are important factors in achieving a good seedbed and overcoming the major identified problem in obtaining a uniform, even, vigorous seedling stand. Surface crusting is greatly reduced by maintaining as high an organic matter level in the surface soil as possible. In fields where crusting is a problem, previous crop trash should not be removed, burned, or buried deeply by implements such as the plow or disc type machines. Manure can be helpful on these soils.

Rate importance of weediness at early seedling stage (rate 0 - 9 scale)

Scale		%	
0 - 3	* Low importance	3	
4 - 6	Medium importance	24	
7 - 8	High importance	39	73
9	* Most important	34	

- Low importance - the crop can tolerate weeds
- Most important - no weeds can be tolerated by the crop

OBSERVATION AND DISCUSSION

Almost three-quarters of the top producers believe that an essentially weed-free seedbed is of great importance. Competition between weeds and the crop for sunlight, moisture and nutrients starts very early. Usually the first plants to occupy any area of soil tend to exclude others. Shallow seeding is an

important factor in this regard as it encourages quick emergence of the crop. Shallow seeding is only possible when there is sufficient moisture near the surface to support germination. See discussion on Page 5 under "Seedbed Preparation".

Most common weeds

	%
Wild oats	88
Wild millet (Green foxtail)	71
Canada thistle	64
Wild buckwheat	43
Sow thistle	36
Pigweed	36
Stinkweed	31
Lady's thumb	29
Lamb's quarters	26
Wild mustard	19

OBSERVATION:

Top producers are aware of their weed problems, with wild oats, wild millet (green foxtail), and Canada thistle being of major concern to the majority.

Fall Applied Herbicide

	%	
None applied	64	
Granular triallate	7	12
Liquid triallate	5	
Phenoxy	19	
Others	5	

Spring pre-emergence herbicides

	%
None applied	82
Liquid triallate	9
Granular triallate	2
Triallate & trifluralin	5
Phenoxy	2

Post-emergence herbicides

	%		
None applied	7		
Phenoxy	43		
Dicamba	31	112	
Bromoxymil	38		
Post-wild oats herbicides	83		Hoe grass - 80% Matevan - 14% Avenge - 6%
Stampede	5		
Glean	2		

Used a wild oat herbicide (Total)

Triallate	Post-emergence	Total
28%	83%	111%*

OBSERVATION

*1. Eleven per cent of the producers either double sprayed for wild oats or used triallate on some of their soft white wheat land, and a post-emergence wild oat herbicide on other soft white wheat land. This explains the 111 per cent figure.
2. None of the top producers gambles on wild oat control. They all use some type of wild oat herbicide. Spring applied post-emergence wild oat herbicides are the most popular type of chemical control.
3. Top producers make good use of broadleaf herbicides including mixes.

Major weeds causing yield loss

1st Choice	%
Wild oats	62
Wild millet (green foxtail)	31
Others	7
2nd Choice	
Wild millet (green foxtail)	33
Wild oats	28
Canada thistle	10
Quackgrass	10

Weediness of crop

	%
None	2
Light	86
Moderate	10
Heavy	2

OBSERVATION

Most of the top producers are aware of their weed problems, take action to control the weeds, resulting in an almost weed-free crop and high yields.

Animal problems

	%
None	74
Gophers	14
Birds	21
Badgers	2

Insect problems

	%
None	55
Aphids	36
Grasshoppers	7
Others	10

Insect control method

	%
None	71
Seed Treatment	20
Insect Spray	9

Yield losses from insects or animals

None to light (5% or less)	100%

OBSERVATION

Forty-three per cent of the producers are aware that a threshold level of infestation must be reached before spraying for grasshoppers or aphids is justified. This is evident by the fact that 43 per cent indicate a grasshopper/aphid presence but only 9 per cent sprayed.

Diseases

	%
None	17
Black point	74
Take-all root rot	36
Common root rot	21
Ergot	19
Leaf rust	19
Others	10

OBSERVATION AND DISCUSSION

Current soft white wheat varieties are susceptible to black point. The most recent information indicates that, unlike some other parts of the world, the black point disease organism

found in southern Alberta is not closely related to common root rot. The extent of damage due to black point is primarily related to moisture conditions, that is, rain or irrigation received during the seed development. The more moisture, the greater the incidence may be of black point. Grain containing black point is usually acceptable for seed, provided that a germination test is performed and a fungicide seed treatment is applied. Rotation will not decrease the incidence or extent of black point. The air is saturated with this fungus, providing sufficient inoculant, regardless of the previous crops grown.

Disease control methods

	%
No control	36
Seed treat	57
Seed resistant varieties	10
Rotation	7

Yield loss from diseases

	%
None to light	86
Moderate	14
Heavy	2

Is disease a major consideration when deciding what crop to seed on a particular field?

Yes — 35%
No — 65%

How often will you sow wheat on wheat stubble if the previous crop showed no disease problem?

	%	
1 year	10	
2 years	26	57
3 years	31	
4 years	10	
5 years	19	
6 or more years	4	

DISCUSSION

Research has clearly shown that monoculture (repetitive growing of the same crop) leads to a build-up of disease organisms for that crop, and under certain conditions, disastrous results can occur. Sometimes, progressively larger yield reductions occur from the build-up of disease organisms and go unnoticed.

How often do you inspect your crop for possible damage?

Average interval — 9.6 days

Rate lodging problem of soft white wheat

		%
0 - 3	Low	93
4 - 6	Medium	7
7 - 8	High	0
9	Severe	0

Type of irrigation system

	%
Center pivot	24
Wheel move	60
Flood	33
	117*

* Seventeen per cent reported a combination of systems.

Indicators used to decide when to irrigate

	%
Soil moisture by feel	81
Stage of crop	50
Appearance of crop	19
When priority call on equipment and labor allows	12
Irrigation scheduling program	10
Soil moisture level by instrument	2

Irrigation schedule

1. **Wheel Move** — **MOST**

   *1st Irrigation - Occurred in the 1st to 2nd week of June at tillering stage and 4 inches were applied.

   2nd Irrigation - Occurred 2nd to 3rd week of July at heading stage and 4 inches were applied.

   3rd Irrigation - Few made a 3rd irrigation. Those that did applied about 3-3½ inches at early dough stage, around the last week of July, the first week of August.

The total amount of water applied to the field by irrigation (fall plus growing season) was about 12-15 inches per acre.

* Remember that, as previously stated, 40 per cent of the producers irrigated in the fall which could be considered a first irrigation.

NOTE: Recent research has shown that a $^{7}/_{32}$ - ⅛" nozzle operating at normal pressure of 45 psi will apply 0.36 inch of water per hour at 75-80 per cent application efficiency. The previous estimate of 0.5 inch per hour has been proven to be too high, and is one of the factors causing farmers to generally underirrigate. It is now estimated that both cereal and hay receive about half or less of the amount of irrigation that they need for best growth (based on wheel roll at 1 set of 11 hours, or 2 sets of 7-¼ hours each, with 2 lines (¼ mile) per 160 acres, on cereals). Consult your irrigation specialist for particulars in your area.

2. **Center Pivot**
   Most started their pivot around the end of May, applying about 2 inches on each circle and made a circle about every two weeks until mid-dough stage in August. This amounted to a total of about 12 inches of supplemental water during the growing season.

   Note: A 4-year study of 28 pivots in southern Alberta showed that for optimum growth of wheat, $^{1}/_{3}$ of the water requirement was being met by irrigation, $^{1}/_{3}$ by precipitation, and $^{1}/_{3}$ was not provided. Normally pivots apply 0.22 inch per day net.

3. **Flood**
   Most producers made two applications, the first at the late tillering stage (about the 2nd week of June) and a second application at the early-dough stage in August.

4. Please refer to the "Consumptive Use Values for Soft White Wheat" graph, and "Growing Season Precipitation" graph, page 12. The average yearly moisture deficit to be supplied by irrigation for wheat is 12 inches.

Swathing versus straight combining

Swathed crop	—	100%
Straight combined	—	0%

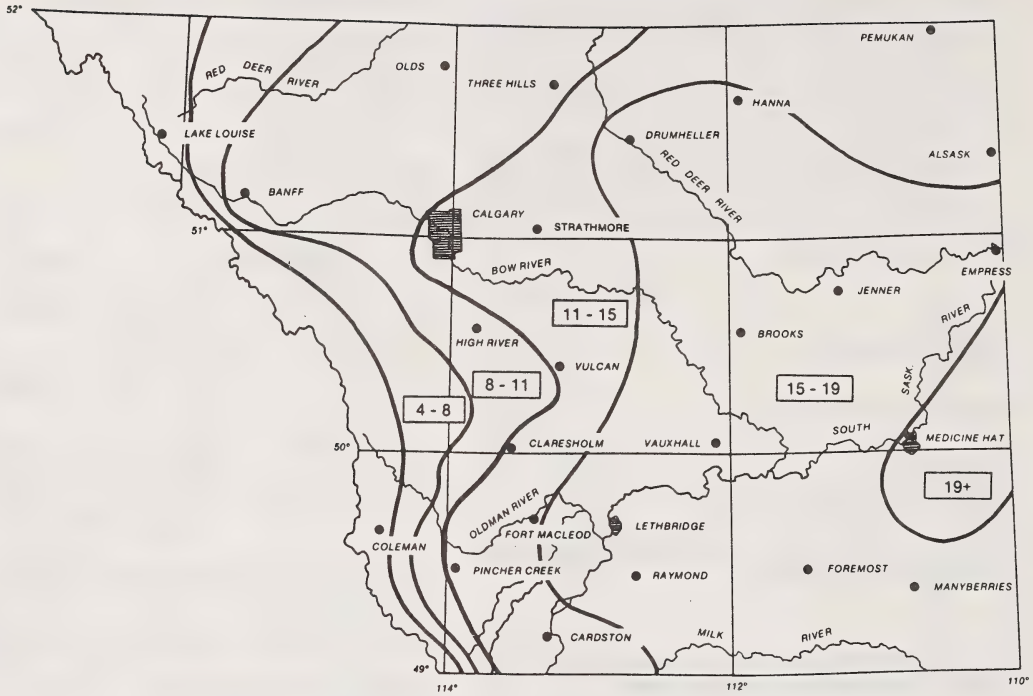


Figure 7. Map showing consumptive use values for soft wheat. (inches)

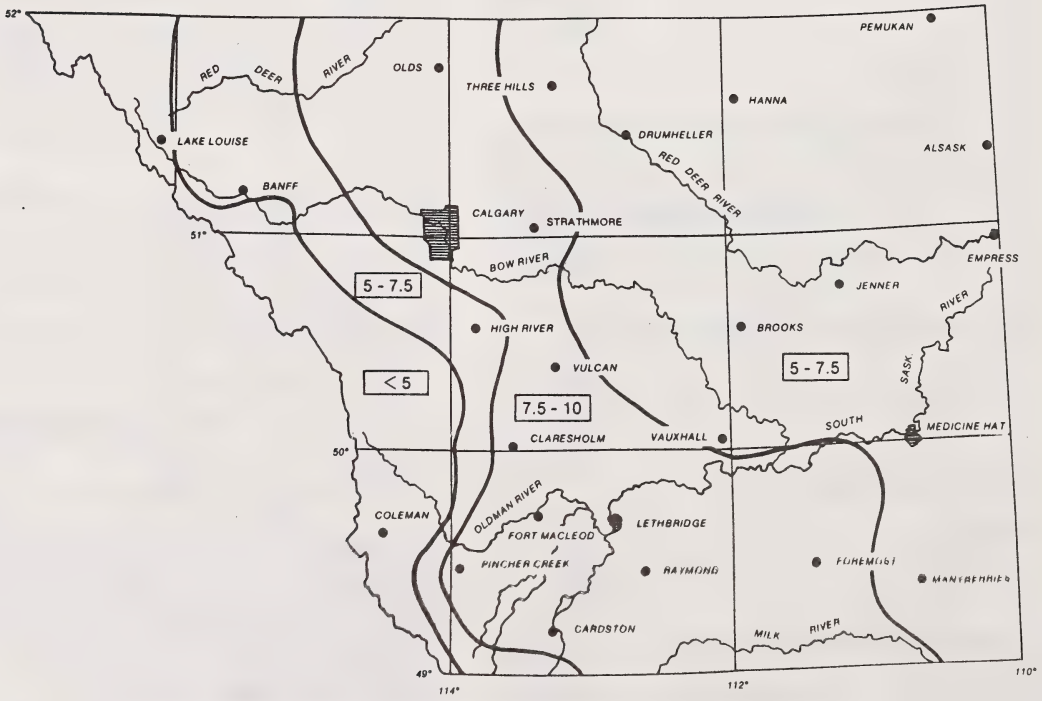


Figure 2. Map showing growing season precipitation (inches) for southern Alberta — long time averages.

The main reasons given for swathing verses straight combining were: (1) uneven ripening, and (b) wind shattering losses reduced.

Do you use stubble management to improve snow trapping?

No	88%
Yes	12%*

* Method used was to leave as much stubble standing as possible.

Moisture of seed at swathing

	%	
Less than 15%	4	
15 - 20%	22	
20 - 25%	33	60
25 - 30%	27	
30 - 35%	9	
Other	4	

OBSERVATION AND DISCUSSION

Physiological maturity in wheat is reached when the moisture content of the grain is 35 per cent or lower. At this stage of crop development, it can be swathed safely without loss in grain yield or quality.

Yields (Bushel/Acre)

	%	Southern* Sub Area	Northern* Sub Area
Yield achieved (1983)	80	84	76
Average of highest yields	92	100	85
5-year average yield	76	79	73

This compares to a provincial yield average of under 60 bu/acre.

* Northern equals Brooks district; southern equals Seven Persons, Vauxhall, Taber and Lethbridge districts.

Dockage

	%
0 - 2%	76
2 - 4%	22
Other	2

Bushel weight

	%	
58 - 60 lb	17	
60 - 62 lb	62	
62 - 64 lb	19	83
64 - 66 lb	2	

Average protein — 10.45%

OBSERVATION AND DISCUSSION

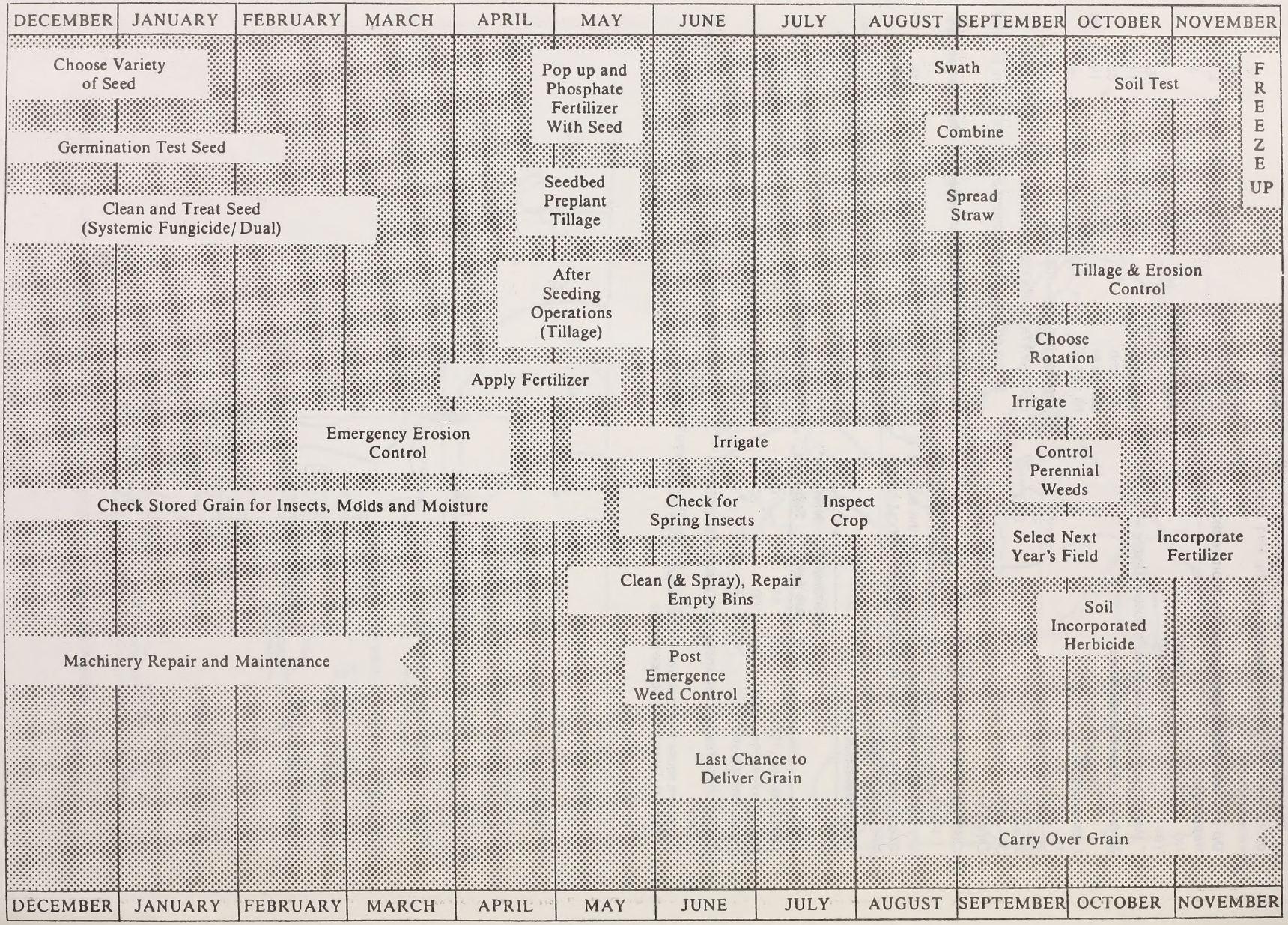
Millers prefer a protein content of 10.5 per cent or lower in soft white wheat.

When grades are lower than expected, what has been the usual main cause?

	%	
Weathering	48	
Black point	29	41
Disease	12	
Frozen seed	17	
Immaturity	14	
Drought shrivelled	10	
Sprouting	5	
Protein	5	

OBSERVATION

Many producers identified more than one cause for grade lowering.


DECEMBER
JANUARY
FEBRUARY
MARCH
APRIL
MAY
JUNE
JULY
AUGUST
SEPTEMBER
OCTOBER
NOVEMBER
Choose Variety of Seed
Germination Test Seed
Clean and Treat Seed (Systemic Fungicide/ Dual)
Pop up and Phosphate Fertilizer With Seed
Seedbed Preplant Tillage
After Seeding Operations (Tillage)
Apply Fertilizer
Emergency Erosion Control
Irrigate
Check Stored Grain for Insects, Molds and Moisture
Check for Spring Insects
Inspect Crop
Clean (& Spray), Repair Empty Bins
Post Emergence Weed Control
Last Chance to Deliver Grain
Machinery Repair and Maintenance
Swath
Combine
Spread Straw
Soil Test
FREEZE UP
Tillage & Erosion Control
Choose Rotation
Irrigate
Control Perennial Weeds
Select Next Year's Field
Incorporate Fertilizer
Soil Incorporated Herbicide
Carry Over Grain

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